Cold Climate Region: Case Study #3
City of Boulder, SmartRegs Ordinance
Single Family Detached, 1960's Vintage

Boulder, CO

Program	SmartRegs Ordinance
Location:	Boulder, Colorado
Building Type:	Single Family Detached
Building Size:	1,262 ft²
Foundation:	Unconditioned Crawlspace
Configuration:	3 bedrooms, 2 baths
SWA Contact:	Lois Arena

The southeastern section of Boulder, CO is an area well known for its small, ranch style homes very often used as rental property. This single family detached home is typical of homes built in the 1950's and 1960's in that section of Boulder. It is a 3 bedroom, 2 bathroom single-story house approximately 1,262 ft² built over a crawlspace foundation.

The property owner for this rental became involved in the SmartRegs process early on for a few reasons. First, her rental license was due for renewal, and she reasoned this was a good time to go through the process. Second, she was hoping to bring the property into compliance sooner rather than later in case the city made the requirements even stricter over time. Lastly, she is the editor of a newspaper in a nearby town and was interested in sharing her experience with her readers.

Efficiency levels in this property were consistent with its year of construction (see table at right). Although the owner is diligent about keeping the property in good condition and performing upgrades as components wear out, other than a couple of window replacements, few energy improvements appear to have been made to date.

This is not uncommon when the renters are responsible for the utility bills. There is little incentive for property owners to make the homes more efficient if they are not responsible for the energy costs. Owner occupants are more likely to insulate and air seal their homes than are rental property owners as it directly affects their comfort and monthly finances.

This home's initial score was 62 points on the SmartRegs checklist. This property owner must make some energy efficiency improvements to comply with Boulder's new ordinance.

Energy Efficient Features

Attic:	R-11 batts
Walls:	Uninsulated
Windows:	Combination of double metal, low-e double wood
Foundation:	Crawlspace ceiling R-19, 20% void
Heating:	Forced air, natural gas, 80 AFUE in unconditioned crawlspace
Cooling:	None
Ductwork:	Uninsulated in unconditioned crawl
Hot Water:	Atmospheric, natural gas, conditioned space, 0.56 EF
Air Leakage:	16.4 ACH@50 pascals, 0.88 ACHn

Additional SmartRegs Features

Low-flow faucets and showerheads

SmartRegs Checklist Score*: 62 points**

(The final score must be ≥ 100)

HERS Index: 180

*100 points on the SmartRegs checklist should approximately equate to a HERS index of 120.

**Original score of 64 was adjusted for a volume correction, the result is a SmartRegs score of 62.

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Boulder, CO

As has been quite common to date, the owner of this property opted to use the prescriptive method of compliance and have the auditor fill out a checklist rather than perform energy modeling to determine if the property was in compliance. The checklist is quicker than modeling, provides answers right on site and does not require the additional time and expense of duct leakage testing. If compliance can be gained without modeling, the checklist is a more economical option.

Because the minimum allowable score is 100 points, the owner will have to improve the property by 2019 in order to maintain the rental permit required by the City of Boulder.

Considering that 100 points on the SmartRegs checklist should approximately equate to a HERS index of 120 points, the HERS index for this home should be considerably higher than 120. For the purpose of this case study, this home was modeled using REM/Rate, a simulation program used to analyze the energy use of residential buildings. As anticipated, the HERS index for this property was determined to be 180, significantly higher than 120.

One goal in creating the SmartRegs checklist was to design a tool that would naturally lead property owners to the most cost-effective and highest impact improvements. For example, many more points are awarded for insulating an uninsulated attic than are given for insulating a slab foundation. Assuming both assemblies are poorly insulated, attic insulation will save much more money, be more cost-effective and is generally easier to implement than slab insulation.

During the first round of development, program developers had intended that no points would be gained if the attic insulation was less than R-19 (see SmartRegs checklist section at right).

Facts about SmartRegs

2 Compliance Paths: Prescriptive or Performance

- Prescriptive: ≥ 100 points on Checklist
- Performance: HERS Index <= 120

Attic is only insulated to R-11.

ATTIC Base:_____ Final:_____

TYPE	25%	50%	75%	100%
No Insulation	0	0	0	0
R-19	6	12	18	24
R-30	6	13	19	26
R-38 or Better	7	13	20	26
Shared Ceilings	7	14	20	27

Attic Section of SmartRegs Checklist

Unfortunately, because neither the checklist nor the manual mention how to handle insulation levels between 0 and 19, the same points are currently being awarded to homes with R-19 insulation and homes with only R-11. Awarding so many points removes the incentive to insulate these poorly insulated attics, an upgrade that would be cost-effective, benefit the occupants and help the City of Boulder achieve it's energy reduction goals. Administrators are aware of this issue and intend to make revisions in the future.

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SmartRegs Compliance (cont.)

Boulder, CO

Various improvement options for this property owner include:

- Crawlspace: insulating the walls to R-19, air sealing and installing a vapor barrier (16 points—includes points for bringing ductwork into conditioned space);
- Reducing duct leakage to 20cfm/100 ft² (5 points);
- Insulating the attic to R-38 (2 points);
- Replacing the furnace with a high efficiency, 90+ AFUE model (17 points);
- Installing an ENERGY STAR refrigerator <= 450 kWh/yr (3 points);
- Blowing insulation into the exterior walls, R12 (20 points);
- Reducing the air leakage to 0.59 ACHn (2 points);

The property owner is free to implement any combination of energy improvements as long as the final checklist score is at least 100. There are several combinations that would bring this home into compliance For example the following two packages would bring the SmartRegs score to 100 points.

Package #1: (+38 points)

- Encapsulating and conditioning the crawlspace,
- increasing the attic insulation to R-38,
- Insulating the exterior walls to R-12

This package results in a HERS Index of 114 and a SmartRegs score of 100.

Package #2: (+38 points)

- Encapsulating and conditioning the crawlspace,
- Increasing the attic insulation to R-38,
- Install a high efficiency furnace
- Replace refrigerator w/ 450 kWh/yr unit

Package #2 results in a HERS Index of 121 and a SmartRegs score of 100.

Note that, while the HERS Indices are slightly different for both upgrade scenarios where the SmartRegs scores are 100, both HERS Indices are very near the intended threshold of 120.

All ductwork and the heating system were located in the vented crawlspace. Insulation was falling down in multiple locations.

Attic is only insulated to R-11.

	Package 1	Package 2
Upgrade Items	Insulate & Condition Crawl Insulate Attic to R-38 Insulate Exterior Walls	Insulate & Condition Crawl Insulate Attic to R-38 Install 90 AFUE Furnace Replace Refrigerator
SmartRegs	100	100
Hers Index	114	121

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SmartRegs requirements were adopted to meet the city's sustainability objectives including environmental health, economic vitality and social equity. According to current statistics, rental properties comprise approximately 50 percent of Boulder's housing stock[1]. Therefore, by requiring property owners to upgrade rental properties, the SmartRegs program aids in advancing Boulder's community sustainability objectives, and will hopefully result in lower energy bills for tenants.

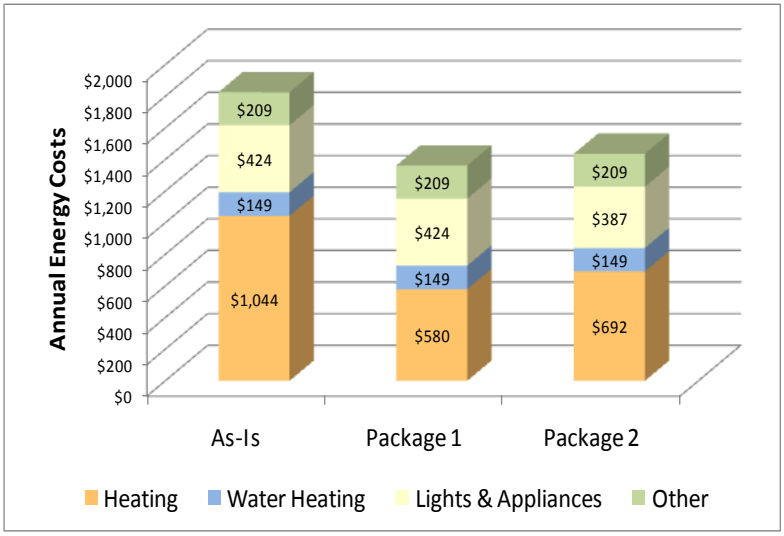
Predicted monthly utility bills for this property as it existed at the time of the initial inspection are displayed in the graph to the right. REM/Rate predicts an annual utility bill of $1,826: about 57%, $1,044, is attributed to heating.

Utility bill savings for the first option package discussed on the previous page—encapsulating and conditioning the crawlspace and insulating the attic and insulating the walls (HERS index of 114) - results in predicted energy savings of $464 per year.

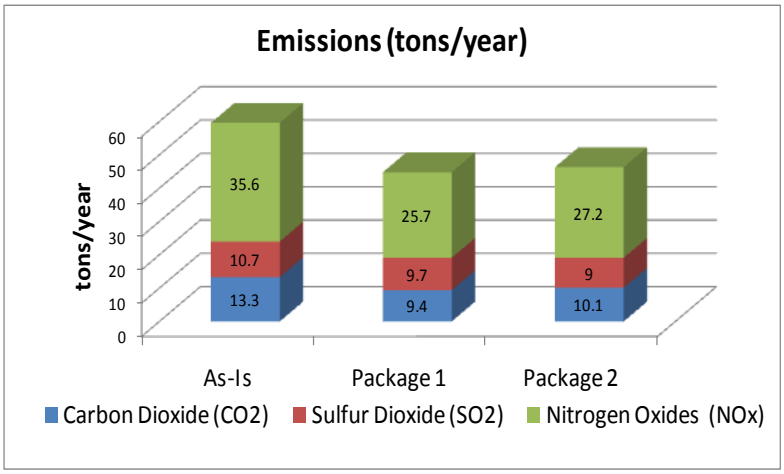
The second option—encapsulating and conditioning the crawlspace, insulating the attic and replacing the furnace and refrigerator (HERS Index of 121) - results in predicted energy savings of $389 per year.

Predicted emissions reductions are significant as well. Both upgrade packages are predicted to reduce NO_x, SO_2 and CO_2 between 9% to 30%, with Package 1 resulting in the greatest savings.

To better analyze programs like SmartRegs, comparisons to actual utility bills are critical. Unfortunately, obtaining utility bills from major providers has been and remains incredibly difficult, even with signed consent forms from homeowners or renters. While this is not necessarily a barrier to program implementation, it is a huge barrier to improving these programs and ensuring that the upgrades being recommended are effective from an energy reduction and a cost-effectiveness standpoint. Removing this barrier is essential in meeting long term program goals.



Predicted utility bills from REM/Rate.



Predicted NO_x, SO_2, and CO_2 emissions from REM/Rate.

[1] *2011 SmartRegs Handbook, City of Boulder*

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The property owner was interviewed to determine her feelings and concerns about Boulder's new SmartRegs ordinance. A summary of her opinions and suggestions for improvements are below.

Q: Why did you decide to participate now and not wait till later in the process?

A: The owner's rental license renewal was coming up in July. She needed to know what the results of the audit would be because she does upgrades in increments – something each year. She also thought that if she complied early and the city decided to make the requirements tougher, she would be grandfathered in.

Q: How long has the owner owned this property?

A: Since 1989. This is the owner's only rental property.

Q: What's the vacancy rate for your property?

A: Although renters often stay for only one year, the owner has no problems renting this property.

Q: What is your normal maintenance routine – i.e., every few months, once a year, on occupant turn over?

A:. The owner typically performs maintenance at changeover, and whenever the occupants inform her that something needs repair.

Q: What are your thoughts or comments for others?

A: There is some confusion over how the bidding process works. This owner thought she was given only 3 contractors to chose from to perform the necessary improvements, but that is not actually the case. Owners are provided a list of over 15 approved contractors (to date) and can chose any three to provide them with bids.

She was also under the impression that the inspector pool was closed making it unfair to others who would like to participate. Populus, the program administrators, state that this is not the case.

Finally, she feels that there is a conflict of interest by allowing contractors to be inspectors.

Overall, the owner didn't think it was quite as difficult as anticipated, but feels the city is not being fair because all homeowners, not just landlords, should have to comply with the same rules.

SWA's response to the last comment is that while it may seem unfair to require this program for landlords and not all property owners, owner occupants are much more likely to improve the efficiency of their homes because it directly improves their comfort and monthly finances. Owner occupants have a much higher incentive to perform upgrades and therefore, their housing stock on average will already be much more energy efficient than the rental property housing stock.

Steven Winter Associates, Inc. is the lead for the Department of Energy's Building America team called the Consortium for Advanced Residential Buildings (CARB).

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